Inside Slot Tech Magazine

MAY, 2003

global g2e gaming expo

Slot Tech Magazine is an official publication of the Global Gaming Expo

Slot Tech Editorial

Have you ever worked on one of those monitors that has what seems like a simple problem at first but turns out to be some sort of possessed demon that will likely need to be repaired with a sledgehammer rather than a soldering iron? A monitor that repeatedly blows the horizontal output transistor can be one such repair. This type of repair can really suck because every time you fire up the monitor to make a test or measurement (or just to see if the darned thing is working) it blows the horizontal output transistor once again.

Of course, if you have a Sencore HA2500 (see Slot Tech Magazine, July 2002) or Sencore's new HA 325 Horizontal Output Analyzer, you'll be able to tell a lot about what's going on without letting the smoke out of the HOT. But if you're stuck working on monitors without the benefit of sophisticated test equipment (and/or you're working on a Kristel monitor that keeps blowing the HOT) this month's Slot Tech Magazine has just what you need. Turn to page 16 and read "When Horizontal Drive Goes Bad or the most interesting tale of why you've just blown twenty bucks worth of horizontal output transistors in the last hour.


Randy Fromm

Once again, Summit, LTD held their annual open house in Billings, Montana. This is an interesting affair as Summit spends a great deal of time and money promoting technical training for their operator customers. While other manufacturers might cringe at the idea, Summit actually sends their customers away from the show floor (where they can try out all the latest offerings from the company) and into a classroom where they are taught the operation, maintenance and repair of the machines and the sub-assemblies that go into them such as the bill validator, ticket printer and monitor. There are some snaps of the show starting on page 30.

This is May - The month for Mother's Day here in the United States of America. It's also my mother's birthday this month. She turns eighty this year and she's still going strong. A world traveler, she plays guitar and piano, sings, speaks three or four languages, and has just taken up writing. Last year, she helped crew a tall ship as it entered the harbor in Amsterdam for some sort of festival of, well, tall ships, I suppose. Anyway, I love my mother dearly and I suppose that one of the best things about publishing a magazine is that I get to tell an entire industry how I feel. Happy birthday, mom. I love you.And happy Mother's Day to both of my wonderful mothers.


My two wonderful mothers, Cathy Sable (l) and Jackie Fromm

That's all for this month. See you at the casino.

Randy Fromm

Randy Fromm - Publisher

Randy Fromm's
Slot Tech Magazine

Editor
Randy Fromm

Technical Writers
Martin Dempsey
Ken Locke
Kevin Noble
Herschel W. Peeler
Scott Reynolds

Advertising Manager
Dennis Sable

Slot Tech Magazine is published monthly by
Slot Tech Magazine
1944 Falmouth Dr.
El Cajon, CA 92020-2827
tel.619.593.6131
fax.619.593.6132
e-mail
editor@slot-techs.com
Visit the website at
slot-techs.com

SUBSCRIPTIONS
Domestic (USA)
1 year - $60.00
2 years - $120.00
International
1 year - $120.00
2 years - $240.00

DON'T LET JUST ANYONE HANDLE YOUR MONEY...

MAKE SURE THEY'RE AUTHORIZED

A bill validator is like an extension of your staff. It's there to make your customer's experience more enjoyable, and to make your life easier. That is why JCM has worked so hard to ensure that our bill validators are one of the most secure and reliable pieces of hardware that you can have on your casino floor. But remember, if you want the quality and trust that comes with the JCM name, you have to make sure you are buying from JCM or an authorized JCM distributor. So take advantage of the best service and performance the industry has to offer.

Buying From JCM Or An Authorized Distributor Ensures:

- You receive the right product
- You receive authentic, quality tested JCM parts
- Your product is backed by JCM's warranty, technical support and service programs
- Training, parts and preventative maintenance are available

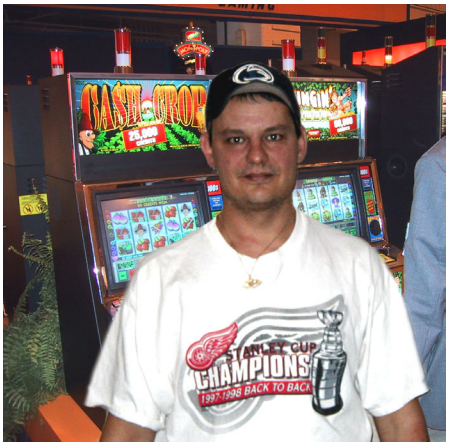
AUTHORIZED DISTRIBUTORS

AG&E American Gaming and Electronics · HAPP CONTROLS · Hi-Tech Gaming · Modern Gaming · PDS GAMING

SECURITY · TECHNOLOGY · SOLUTIONS

JCM® AMERICAN CORPORATION

JCM American Corporation
925 Pilot Road
Las Vegas, Nevada 89119
Tel: 702.651.0000
Fax: 702.644.5512
email: sales@jcm-american.com
www.jcm-american.com



The Big Project Continues

The Time Line

By Kevin Noble

As the time line passes and all 180 games should be on the floor, many surprises have put the last phase on hold. The Bally video mains were not approved for Ontario and they are currently on field trial at another site so until then, we wait until the mains get approved from the gaming commission. Since then, the install team has moved on to other sites. Collectively, we did manage to install around 130 games. We also installed eight Bally reel "Betty Boop" games (originally in the last phase) that are currently up and running which brings our total to about 51 games remaining.

Bumps in the Road

This project has seen many twists and turns in this road, but nothing like what we have ever experienced in the countless projects over the last four years. In the past 18 months we have done numerous upgrades, conversions and machine moves with the usual minor problems that go along with these projects. What was basic procedure for the last four years (for us, anyway) was not truly what was written in the Internal Control Manual that was followed by Compliance. To make a long story short and omitting names, many technicians received procedure violations because of the short time line.

The Pressure, Oh the Pressure...

The time line that was drawn up for us was pretty tight. It was attainable (when cutting the odd corner) but not impossible. We were pushed to the point where tasks and duties were scanned and not fully inspected. We were rushed and short cuts were taken in order to attain the goals. Needless to say, many things were missed because of people being removed off one task to begin another. Likewise, nobody remembered where they had left off. The plan was simple. It was the same plan for the last four years (only a little bigger in a much shorter time span) to the point where it had become routine for us. Then, it was abandoned (no fault of our own) because of the time line.

The Future

The first week of February passes by us. We are informed that the new bally video mains have passed the field trial and are now approved for Ontario. The planning process starts again and the paper work will be submitted. The new date is now set for the last week in February (24 games) and the first week for March (27 games).

Phase 4

Phase four begins like any other machine swap except for the bally mains (7-08's) on the Betty Boop progressive must be swapped out immediately because of a problem when a certain game goes into the bonus round. Our priority started with the unsealing of the CPU boards, EPROM change, clearing and setting the options, coin and bill testing, and having these games ready for AGCO in the morning.

Through the night, the afternoon technicians were able to bolt two out of the three banks, wire up one bank, and install the main door locks on another. Mark Robinson from Bally Gaming in Ontario, arrives to perform the main change along with support for the new bally video mains. Mark provides us with some training on the new clear and set procedures, along with explaining all the new option features with the new mains. Mark also sticks around for any problems with the Betty Boop games that are being inspected by the gaming en-

VDC
Video Display Corporation

Popular High Resolution 14" Monitor Tubes with All New Yoke

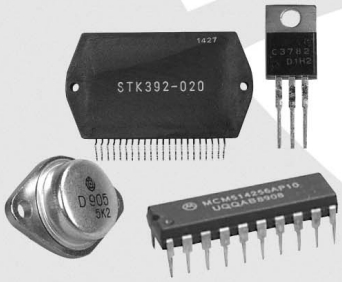
Order #142-158
Video poker machines (M34-1492)

Order #142-160
Touchscreen video poker machines (M34-K2M40xx11)

NTE
ELECTRONICS, INC.

Lightwave™ LED Flashlight

Order #29-4015
•Built for durability •Operates on three "AAA" batteries •Model #LW-2100



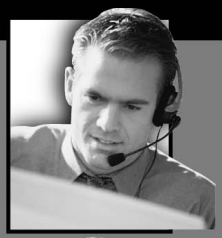
MCM stocks over 10,000 quality semiconductors

TPP TENMA

True RMS 5000 Count Autoranging Digital Multimeter

Order #72-2040A
•Capacitance and frequency measurement
•Diode test •20KHz bandwidth

Over 40,000 Products Stocked



FREE CATALOG

- Access to over 1.5 million electronic parts and related products
- Superior customer service
- Special offers and discounts
- Quotation team, send us your quotes for quick response
- State-of-the-art automated warehouse

call toll free
1-800-543-4330
or visit
www.mcminone.com/magazine

MCM
an in one company

Source Code ST03

forcement officer. Today AGCO was able to inspect the Betty Boop games and have them up to the public by the afternoon.

On the third day of this project, all locks were in place, all banks were wired, IDX's all programmed, all games were 6-pointed and many of the boards were sealed by AGCO.

Day four was the last and final day. All games were verified, sealed, and final inspected by AGCO, with all games up and running by the time our shift had ended.

Phase 5

I was unable to attend the phase 5 project because I attended TechFest 6 in central Michigan. The facts that I have gathered are from another technician working the project and should have mirrored phase 4.

What a Difference a Month Makes

What I mean by this was is that once we knew what the procedures were, things went smoothly. All procedures were followed, nobody got in trouble, and everyone was happy. The time line was reasonable, and we had a lot of help from our Impressment team loading up the old games on the truck. Our operations manager even helped with installing location and asset tags, and CPU locks. We also had ample time to repair what problems we discovered.

Few Glitches

Again, like any project there were some glitches, but nothing to major to hold us down. We had one CPU board that needed replacing. After all the games were inspected and sealed by AGCO the next morning, we noticed that famous burning Silicon smell. U4 and U5 were burnt and split lengthways along the IC. A handful of games had the drop wires reversed when the Mikohn was installed at the warehouse, and a couple of games had the dipswitch setting incorrect which were found during our inspection.

The Modification
Bally Traditional Video

We discovered about a year ago or so that we were having massive coin jams on our nickel games in the drop chute exit on the door panel causing service reports. We tried many different experiments without damaging the existing chute, but we found the best result when we used a nipper to open the drop chute a little larger then the 5-cent token. We needed approval for the first game from AGCO to continue. After the approval, we open up the remaining games, thus eliminating the drop jam and the service report.

The New Mains

With the games being up for over a month now, we are discovering a couple of small problems with the machines. The first problem we are now encountering is the machines going into constant hopper jam and hopper error codes. The jams are not really a jam but replacing the hopper board cures the problem. These errors usually occur when the hopper has just been filled.

The other thing we stumbled upon (but the install crew was already aware of the problem and did not tell us) was discovered when we started the bill testing. The Mikohn incremented correctly and the soft meters incremented correctly but the games credit on the monitor incremented as if it was a quarter no matter what denomination it was. When cashing out the credits it counted down by 8, still giving out the correct amount of coins. This was repaired by re-clearing the SafeRam, re-optioning the game, and bill testing the machine for the correct amount of credits.

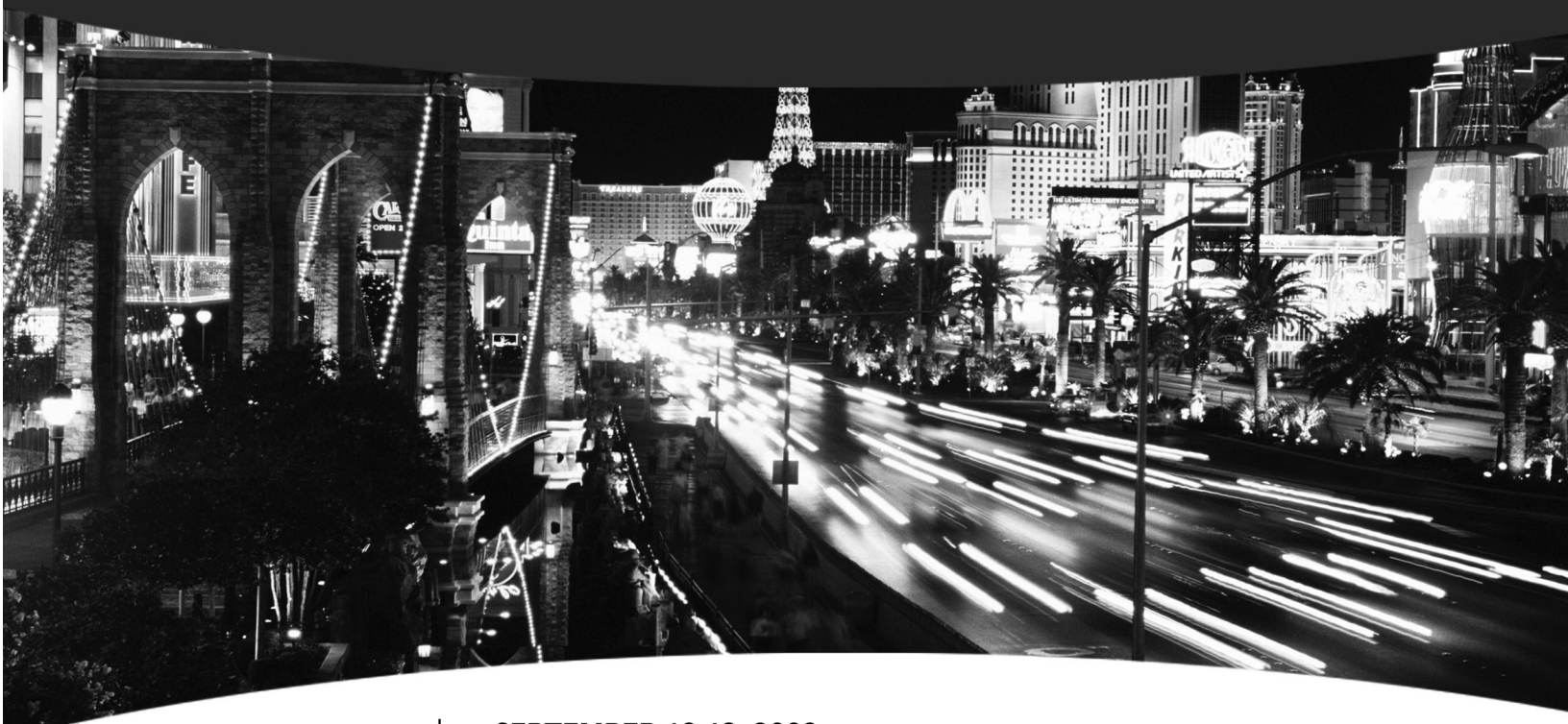
Overview

From the first phase to the last, the correct policies were in place from day one but we continued to perform your tasks the way we knew. From the beginning to the end of this project, we learned of the correct procedures the hard way. We have had a department meeting with the Operations Manager concerning the mistakes made, and stated the fact that we were never alerted until a procedure was broken. Since then, we have had the Betty Boops and Atronic games come to the floor without any problems. We had unbelievable support from the guys on the install team, the Impressment team, and from the regular Technicians that work at the site.

- Kevin Noble
knoble@slot-techs.com

over 13,000 of your toughest competitors attended G2E last year.

(maybe they know something you don't.)



global g2e gaming expo

SEPTEMBER 16-18, 2003 • LAS VEGAS CONVENTION CENTER

SEPTEMBER 15, 2003 • G2E TRAINING & DEVELOPMENT INSTITUTE

Maybe they spotted the trends and got in on a good thing at the right time. Maybe they learned what they needed to know about new products and technologies to get a competitive advantage in a tight market. Maybe you'll join them at this year's Global Gaming Expo (G2E). And come away with what you need to stay competitive.

Get in the know and enjoy discounts to the Show and Conference.

Register by August 18 at www.globalgamingexpo.com/ad

An American Gaming Association Event

Organized by Reed Exhibitions

1-888-314-1378

1-203-840-5626

Atronic Among the Top 100 Employers in Europe

European Commission Congratulates the Company

Ten years after its foundation, Atronic - one of the three main pillars of the business activities of the Gauselmann Group - is one of the 100 most attractive employers in the European Union.

"A powerful performance", was the comment of the competition office of the "Great Place to Work in Europe" in Copenhagen.

The awards at the European level were preceded by competitions in various countries within the European Union. Atronic gained an outstanding 8th place among the 25 most attractive employers in Austria. Here, the competition was provided with journalistic support by the popular Austrian business magazine "trend". The results are to be found in its March issue.

For the company's owner Michael Gauselmann, who founded the still young Atronic only 10 years ago, the qualification for the national competition in Austria in autumn 2002 was already both recognition and a challenge.

"The ranking among the top 100 in Europe is wonderful recognition of our creative and consistent employee orientation in recent years and a terrific birthday present for our ten-year anniversary which we will celebrate on May 9, 2003 in our development centre in Austria", according to Michael Gauselmann.

This award will encourage the process of the self-critical analysis of our own positions and strategies within the company. The knowledge thus gained will help the company to optimize its answers to future challenges and to further develop the corporate vision of "great games - great people", in other words, the equal importance of products and people in the company's everyday business.

Throughout Europe, more than 1,000 companies took part in the various competitions. About 239,000 employees were asked to reply anonymously to questions and finally approximately 150,000 returned questionnaires were evaluated. Anna Diamantopoulou, a member of the European Commission, was able to point to these impressive numbers at the prize-giving ceremony in Brussels. Atronic was represented at this high-class event by Armin Gauselmann, member of the Executive Board of

Gauselmann AG, and Claudine H÷rmann G÷ttersdorfer, Human Resources Manager at Atronic International.

“This result will spur on the young and multicultural team of my brother Michael Gauselmann and motivate them to continue on the way they have chosen. The team, Atronic and the entire Gauselmann group, all have good reason to be proud of this milestone!” commented Armin Gauselmann. Atronic International and sister company

Atronic Americas are members of the family- owned and operated Gauselmann Group, which has sold more than 1.8 million machines since inception, and 100,000 gaming devices in the year 2002 alone. Atronic, the world’s third largest slot maker, is headquartered in Germany, and has offices in Australia, Austria, Great Britain, Peru, South Africa, and the United States of America. Atronic is dedicated to producing only the highest quality of entertaining games and products, which are being operated in 77 countries worldwide. Atronic holds a total of 144 worldwide gaming licenses including the United States of America, where it is licensed to sell machines in 22 states and to 115 tribes. To find out more information about Atronic, please visit the Web site at www.atronic.com or call 1-800-864-7670.

What's NTE got that I can't give you?

Substituting Replacement Components

By Herschel Peeler

How many repair components do you keep in stock? Hundreds? Thousands? Would you like to keep your inventory of repair parts to a minimum? There are a few distributors out there that stock "Substitute" parts for many common parts you use. Their prices seem a little heavy. These lines like NTE and such sell a substitute for almost everything it seems. It looks to me that they buy a part in high volume, put their part number on it and resell it.

For instance, the ever-popular 1N400x series of 1 Amp rectifiers come in various voltages.

1N4001 - 50 V
1N4002 - 100 V
1N4003 - 200 V
1N4004 - 400 V
1N4005 - 600 V
1N4006 - 800 V
1N4007 - 1,000 V

These distributors purchase the 1N4005 model by the zillions, have NTE116 stamped on it and sell it as a substitute for 1N4001, 1N4002, 1N4003, 1N4004, or 1N4005. This works fine because a rectifier may be used at any lower voltage with no penalty. They peddle the NTE116 as a substitute for anything from a 1N645 to... well anything rated at less than 600 Volts at 1 Amp. The NTE part may set you back a goodly portion of a US dollar. Why don't you just buy the 1N4005 and stock it as a substitute for anything that crosses to an NTE116? A 1N4005 can set you back around a nickel.

The NTE116 is an equivalent to a 1N4005, meaning it matches all rated characteristics. These are a substitute for, maybe, a hundred devices with lower ratings, meaning it meets or exceeds these ratings.

How does NTE, and their kind, get away with doing these dastardly deeds? They are not just "feeky snuckers" taking advantage of you. They do their engineering homework and buy prime, high quality components in quantity. If you could do comparable engineering, you could do as they do. I'm no engineer, but I can do enough to take a chunk off of our petty cash expenses for repair parts. (Note: NTE is used primarily in this discussion for reasons of popularity and reference only.)

Let's take a look at some of the more popular devices we use, their NTE listed substitutes, cross those back to common part numbers and make ourselves a list of NTE Substitute Equivalents.

1N4001 through 1N4005 crosses to NTE116. The NTE116 is equal to a 1N4005. Most any 1 Amp (or less) silicon rectifier rated at 600 Volts (or less), not requiring speed.

1N4006, 1N4007 crosses to a NTE125. The NTE125 is equal to a 1N4007. Most any 1 Amp (or less) silicon rectifier rated at 1,000 Volts (or less), not requiring speed. I see no reason a 1N4007 could not be used for any 1N4001 to 1N4007 device. I suspect the only reason for having NTE116 and NTE125 is a purchasing prerogative. The 1N4007 in a glass passivated prime quality could be a high price substitute for a 1N4001 plastic passivated ($0.02 a piece) part.

For the purpose of gaming machines, I would suggest stocking the plastic passivated 1N4007, and use it for all 1N400x devices. They may be obtained for around a nickel in medium quantities for most distributors.

1N4148, 1N4448, 1N914 (and most silicon signal diodes used in digital circuits) crosses to an NTE519. The NTE 519 is an equivalent to a 1N914. Buy 1N914. The 1N4148 will do in most circumstances when currents are in the 10 mA range. The 1N914 is rated at 100 mA. If you need it, get 1N914s. If you are dealing with low level digital circuits, use 1N4148. Both are available for pennies apiece. These are not high speed devices by today's standards, and will work poorly, if at all, in circuits requiring high speed (50 ns or faster) devices.

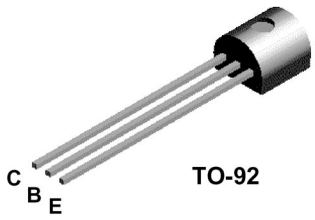
This same thing can be done for most diodes. Match or exceed speed, current, and voltage ratings.

Transistors

Let's take another popular example. TIP31 is used in many circuits (DC Ballast for fluorescent lamps, for example). We find the TIP31 (cheap version) crosses to an NTE196. Higher voltage rated members of this same family (TIP31A, TIP31B, and TIP31C) all cross to an NTE291. The primary difference is breakdown voltage. TIP31C is the highest, so let's just stock the

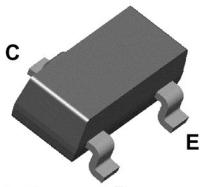
FAIRCHILD
SEMICONDUCTOR TM

2N4401



TO-92

MMBT4401



SOT-23
Mark: 2X

NPN General Pupose Amplifier

This device is designed for use as a medium power amplifier and switch requiring collector currents up to 500 mA.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current - Continuous	600	mA
T_J, T_{stg}	Operating and Storage Junction Temperature Range	-55 to +150	°C

*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

NOTES:
1) These ratings are based on a maximum junction temperature of 150 degrees C.
2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

Thermal Characteristics

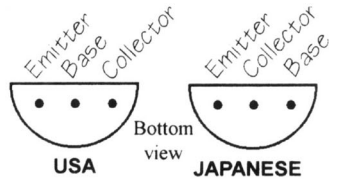
TA = 25°C unless otherwise noted

Symbol	Characteristic	Max		Units
		2N4401	*MMBT4401	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	350 2.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	357	°C/W

*Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

TO-92 Package

This is the smallest transistor that you commonly will find in monitors, power supplies and other circuits (other than SMDs or surface-mount devices). It is often called a "signal transistor" as it can handle only 1 amp of current.



TO-220 Package

This package can handle up to 10 amps. We use transistors in this package as lamp matrix and solenoid drivers in slot machines. You also see this package in power supplies.

TO-218 Package

The TO-218 package is a larger version of the TO-220 package. It's used in many of the same applications as well. Most monitors use a TO-218 package for the horizontal output transistor.

TIP31C at $0.60 a piece instead of the NTE291 at $3.30 a piece, and use it for all TIP31, TIP31A, TIP31B, and TIP31C, or equivalent, applications.

To take another example, 2N2222, 2N3904, 2N4401, PN2222, PN3904 and most general purpose NPN transistors used in the digital or gaming industry cross to an NTE123A. Let's just stock a 2N4401 we can pick up at less than a dime apiece instead of the NTE123A at $1.25. Watch for changes in pinouts. TO-92 devices come in various pin configurations, depending on whether they are USA, Japanese or European. See pinout chart at the left side of this page.

It has a brother, the PNP version, 2N2907, 2N3906, 2N4403, PN2907, PN3906 and most general-purpose PNP transistors cross to an NTE159. Stock the 2N4403. Same comment about watching pin configurations.

TRANSISTOR SUBSTITUTION GUIDELINES

It's as easy as 1-2-3!

1. I_C Use the same or higher.
2. V_{CEO} Use the same or higher
3. h_{FE} Try to match as closely as possible

Both of these will cross equally to most NPN and PNP devices used in general digital and low voltage low current applications for the European and Asian part number systems. If it crosses to an NTE123A or an NTE159, the PN3904 or PN3906 should work suitably.

Zener Diodes

Match Zener voltage, watch 5% or 10% values (when in doubt use the 5% rated value). It is not a good idea to substitute a higher wattage rated device for a lower rated one. If you've ever done "The Diode Exercise" you realize that the Zener voltage does change at a given current between 1/4 W, 1/2 W, and 1 W devices. In general it's safe to substitute 1/2 Watt rated devices for 0.4 Watt rated devices. Not much cross substitution can be made here.

Bottom line

You can save a notable chunk in your budget, as well as shelf space, by being smart about what devices you carry as repair parts.

- Herschel Peeler
hpeeler@slot-techs.com

IGT Selects Money Controls' Condor Plus for New Gaming Platform

Money Controls, a leader in coin and bill transaction products, announces the selection by IGT of Condor Plus as the product of choice for IGT's new AVP hardware platform.

The Condor Plus electronic coin acceptor is the next generation in the very successful Condor line featuring added levels of security and flexibility while also forming the basis for Money Controls' movement into developing USB capability.

"By selecting our Condor Plus system, IGT is taking its coin validation security to the next level and positions us very well into supporting the market's move toward implementation of USB, " states Ron Rollins, Sr. Vice President and General Manager of Money Controls, Inc. "We have worked with IGT for many years and are pleased to partner with them on technology-based solutions for their designs".

"After extensive testing and development between the IGT and Money Controls design teams, we determined that the technology used in Condor Plus was the right choice for the small coin offering on the AVP platform, " confirmed Randy Hedrick, Vice President Hardware Engineering and Advanced Technology.

Utilizing advanced detection techniques, the Condor Plus offers unique programming flexibility. Although not widely used, Condor Plus already facilitates serial communications derived from Money Controls' wide range of existing serial products, making the leap to USB a hill rather than a mountain. Condor Plus provides the highest levels of performance and security with low maintenance and downtime, and is designed to provide exceptional performance for the gaming market, setting a new standard in the industry.

"Condor Plus is a sophisticated, top-of-the-line coin validation system that is secure, yet flexible enough to meet the demands of the very fluid gaming market. Money Controls is very proud to partner with IGT on this project," adds Rollins.

Money Controls, Inc. has been a global provider of automated transaction solutions for the gaming, specialized vending, transportation, telecommunications and amusement markets for more than 40 years. A premier manufacturer with a global presence, Money Controls continues to set new standards in the gaming industry.

For additional information on Money Controls, visit the company web site at www.moneycontrols.com or contact Money Controls' Las Vegas office at 702-739-8263

IGT is a world leader in the design, development and manufacture of microprocessor-based gaming and video lottery products and software systems in all jurisdictions where gaming and lotteries are legal.

For more information on IGT, visit the company web site at www.IGT.com.

Slot Tech Magazine

SII Secure

If a cashless gaming printer goes down, the game is over.

Money is out the window. Customers get upset. And how long will the printer take to replace or repair? Here's how to change this whole scenario. Insist on Seiko Instruments Inc. thermal ticket-printing solutions.

They redefine the word trouble-free. There's no ribbon to change. No ink. No jams. No misprints. And as for maintenance—all you do is drop in a new stack of fanfold paper.

But that's just one part of the game plan. To achieve totally reliable printing takes total attention to detail. And our SII Solutions Team will provide whatever engineering, software support and training you need. In fact, we've helped over 20 major game makers get up and printing—and stay up and printing.

So go with the printers that never stop. Just call 800.553.6570 ext. 106 or visit our website for all the details. **And make sure you're SII Secure.**

SII
Seiko Instruments Inc.
www.siiprinters.com

When Horizontal Drive Goes Bad

or the most interesting tale of why you've just blown twenty bucks worth of horizontal output transistors in the last hour

Most technicians are at least somewhat familiar with troubleshooting the horizontal output stage of monitors. This is after all, where we have a high failure rate in components like the horizontal output transistor, retrace tuning capacitors and flyback transformer so we're in this section a lot. With a little bit of experience under your belt, it doesn't take long before you're diagnosing and repairing horizontal output failures with the best of 'em.

But what about problems in the horizontal drive circuit? These problems can be a lot trickier to diagnose and repair, especially when compounded by the two limitations faced by most slot machine technicians: lack of an oscilloscope and lack of the detailed knowledge of electronics needed to track down these somewhat more obscure failures.

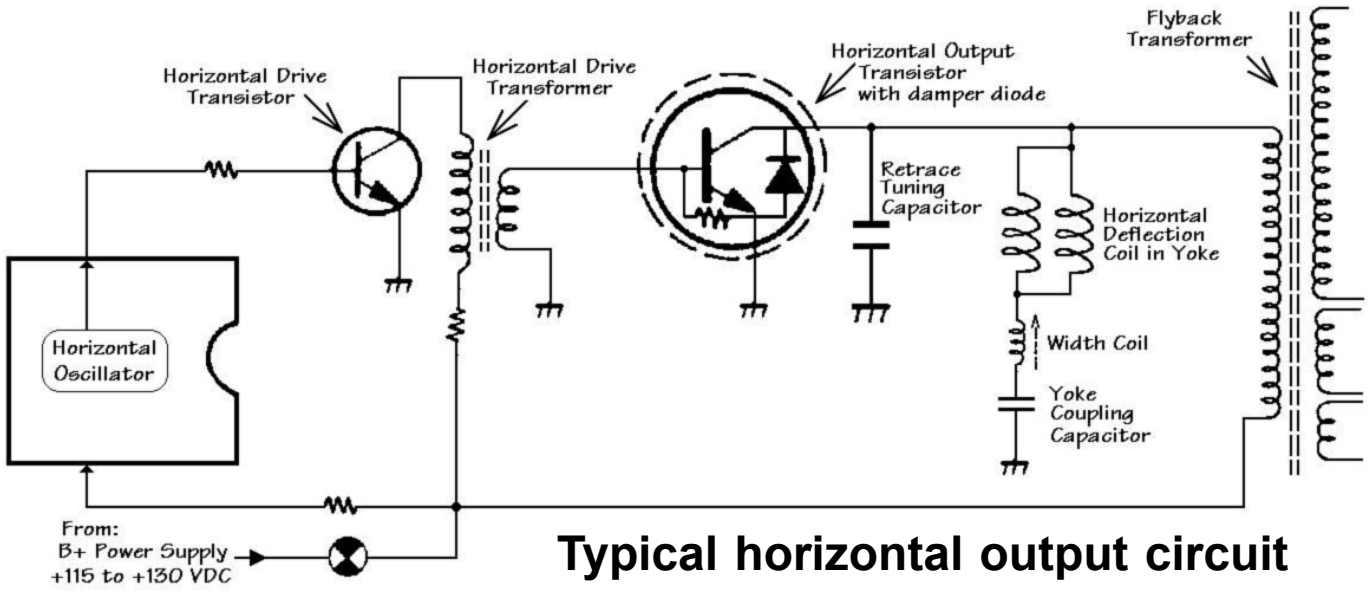
The Horizontal Drive Circuit

We looked at the horizontal deflection circuit in the December 2002 issue of Slot Tech Magazine. As you will recall from our previous discussion, the horizontal deflection circuit is similar in most monitors. In fact, it is almost identical in just about every video slot monitor in use today.

The Horizontal Drive

Just for the sake of review, Let's take another look at the horizontal deflection circuit. Inside an IC on the monitor's printed circuit board, there is a circuit known as the "horizontal oscillator." The horizontal oscillator is used to generate a square wave AC signal. The frequency of the oscillator will vary, depending on the resolution of the monitor. In a "standard resolution" monitor (A.K.A. NTSC or CGA resolution) the frequency of the oscillator is approximately 15,750 Hertz. In a VGA monitor (640 X 480 resolution) this frequency is doubled to 31.5 kHz. Speeding up the frequency of the horizontal oscillator allows the monitor to display more lines each field. Double the frequency and you've doubled the vertical resolution.

Although this signal will eventually be used to power the



Typical horizontal output circuit

horizontal deflection coil in the yoke (as well as the flyback transformer in the high-voltage unit) it is still very weak at this point. It has to be amplified.

The output of the horizontal oscillator is connected to the base of the horizontal drive transistor. This makes sense because in a common-emitter amplifier like this one, the base is the input. The weak signal from the oscillator is amplified by the horizontal drive circuit to obtain an output of around 100 VAC.

Note that there is a transformer primary winding in the collector load circuit. This small transformer (appropriately called the horizontal drive transformer) is used to change the high voltage, low current output of the horizontal drive circuit into a low voltage, high current signal. This high current signal is then connected to the base of the horizontal output transistor.

It is critically important that the horizontal output transistor is in one of two states: It must be either completely turned off — a condition known as "cutoff" — or it must be completely turned on, which is called "saturation." As the transistor makes the transition from one state to the other, it passes through something known as the "linear" region of the curve. If the horizontal output transistor is allowed to remain in this region of conduction for any appreciable length of time, it will burn up. Here's why:

When a transistor is in cutoff, it can't burn up due to excessive heat because it is completely turned off. When a transistor is in cutoff, there is absolutely no current flow through the transistor so how the heck could it possibly get hot? Of course, it cannot.

When the transistor is saturated, it likewise will not burn up but for a completely different reason. When the transistor is saturated, it will have a ton of current flowing through it (this is when the current flow is at its maximum, in fact). However, it doesn't get too hot because there is almost no resistance at all between the collector and emitter of the transistor at this time. Since there is little or no resistance, there is little or no power lost (this is known to the truly hip as "IR Drop.") as the current flows from collector to emitter through the transistor. The bottom line is this: No resistance, no heat.

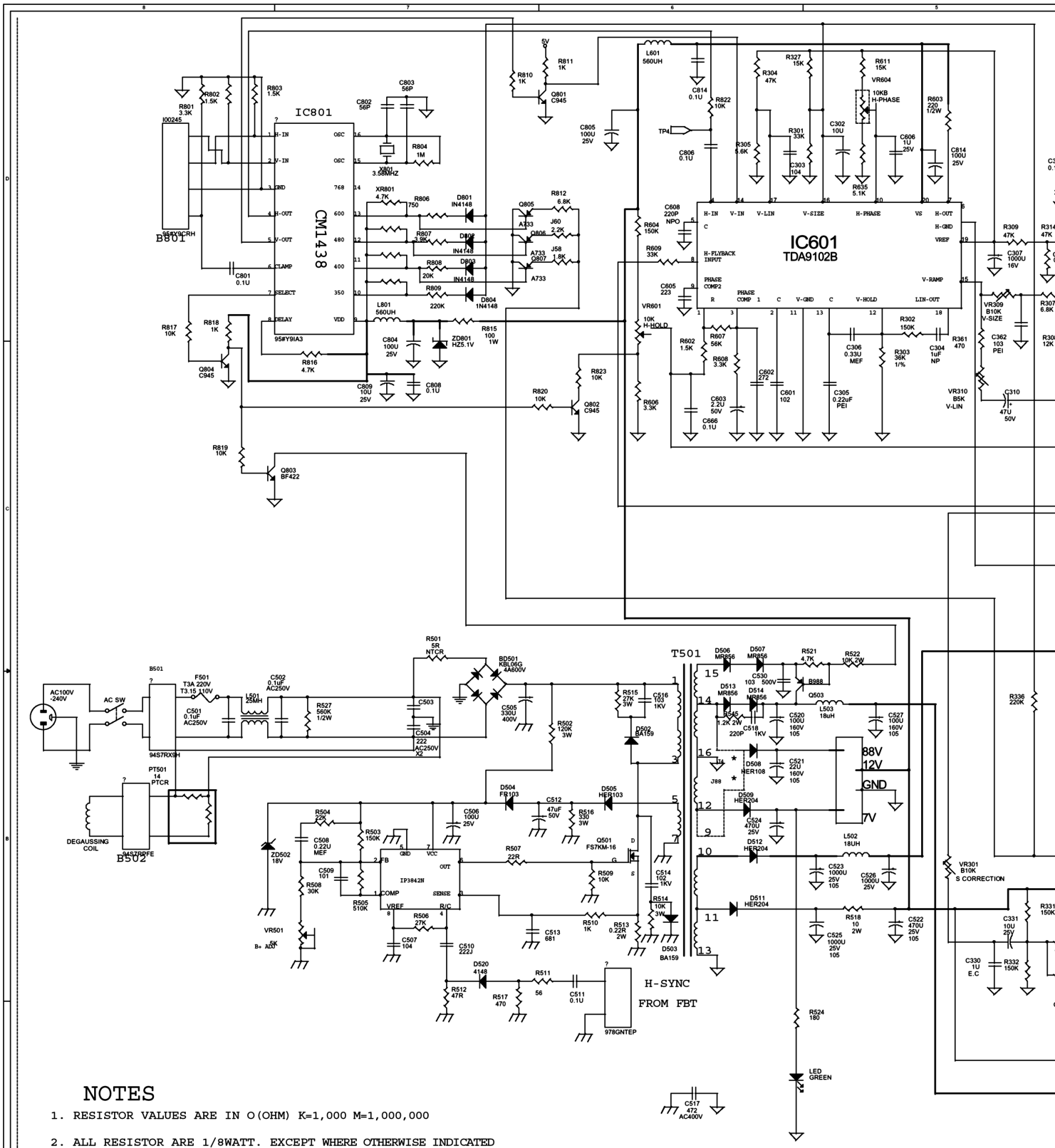
There is a third operating condition for transistors. It's known as the "linear" region of the transistor's operating curve. In this mode, the transistor is neither fully turned off, nor is it fully turned on. It is, in fact, operating as a sort of resistor. This is actually the origin of the name "transistor." It came from "transfer resistor" as a change in base current is translated into a change in resistance as measured between the emitter and collector. More current equals less resistance.

For some types of electronic circuits, it's perfectly acceptable for the transistor to operate in the linear region. In fact, it's mandatory for circuits such as audio amplifiers. But the horizontal output circuit is a switching application. If the horizontal output transistor fails to saturate completely (leaving it hanging in the linear region) there will be resistance between the collector and emitter. This will cause excessive IR drop across the transistor, quickly generating excessive heat and wiping out the transistor.

But what can cause the transistor to fail to saturate completely? What can cause the horizontal drive to exist but not be sufficiently powerful such that it can drive the horizontal output transistor into saturation? That, my friends, is the actual point of all this (You knew there would be a practical point to all this, didn't you?).

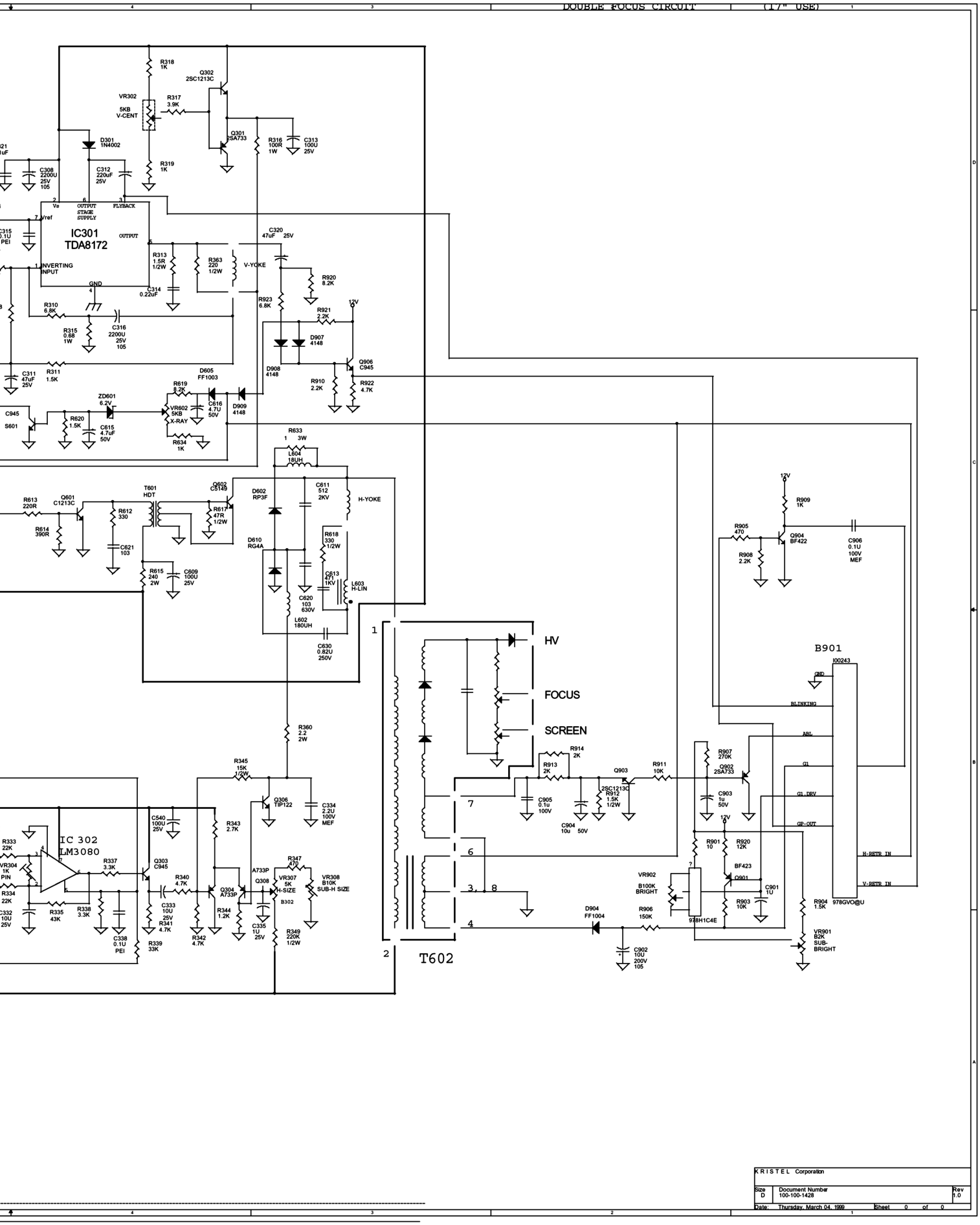
Kristel 1428

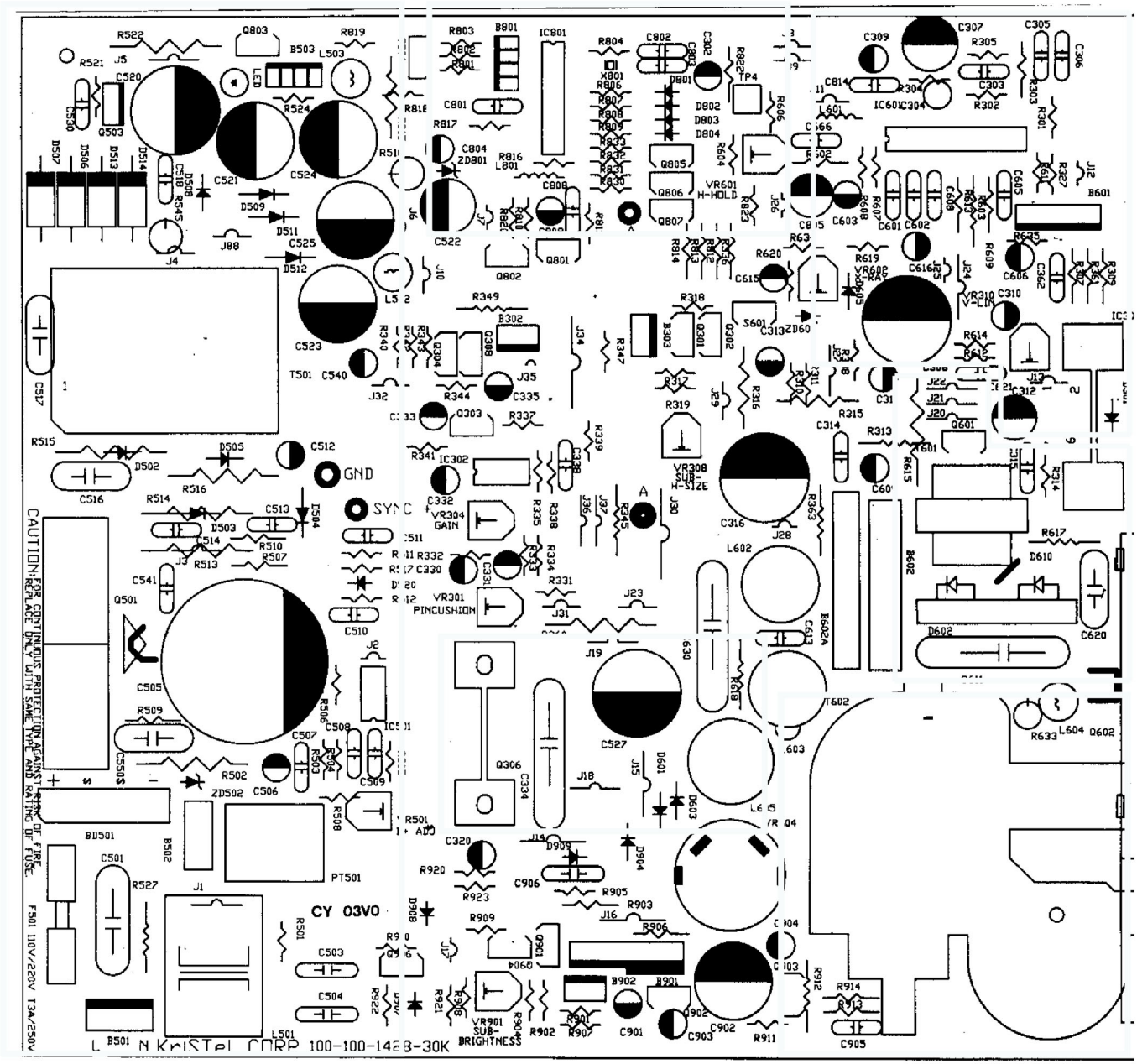
There is a common failure in Kristel's Model 1428. The nature of the failure is that it blows the horizontal output transistor. That, in and of itself, is really not unusual nor surprising. Horizontal output transistor failure ranks right up there as one of the most common of all monitor failures. You fire up the monitor, the screen is blank, there is no high voltage and there is a subtle ticking or chirping



NOTES

1. RESISTOR VALUES ARE IN O(OHM) K=1,000 M=1,000,000
2. ALL RESISTOR ARE 1/8WATT. EXCEPTWHERE OTHERWISE INDICATED
3. CAPACITOR VALUES ARE IN uf UNLESS OTHERWISE INDICATED P=pf
4. ALL CAPACITOR ARE 50 VOLTS EXCEPT WHERE OTHERWISE INDICATED
5. J88:15" USE J4:14" USE.


DOUBLE FOCUS CIRCUIT
(17" USE)
IC301
TDA8172
IC 302
LM3080
T602
B901
HV
FOCUS
SCREEN
H-YOKE
V-YOKE
KRISTEL Corporation
Document Number
100-100-1428
Thursday, March 04, 1999



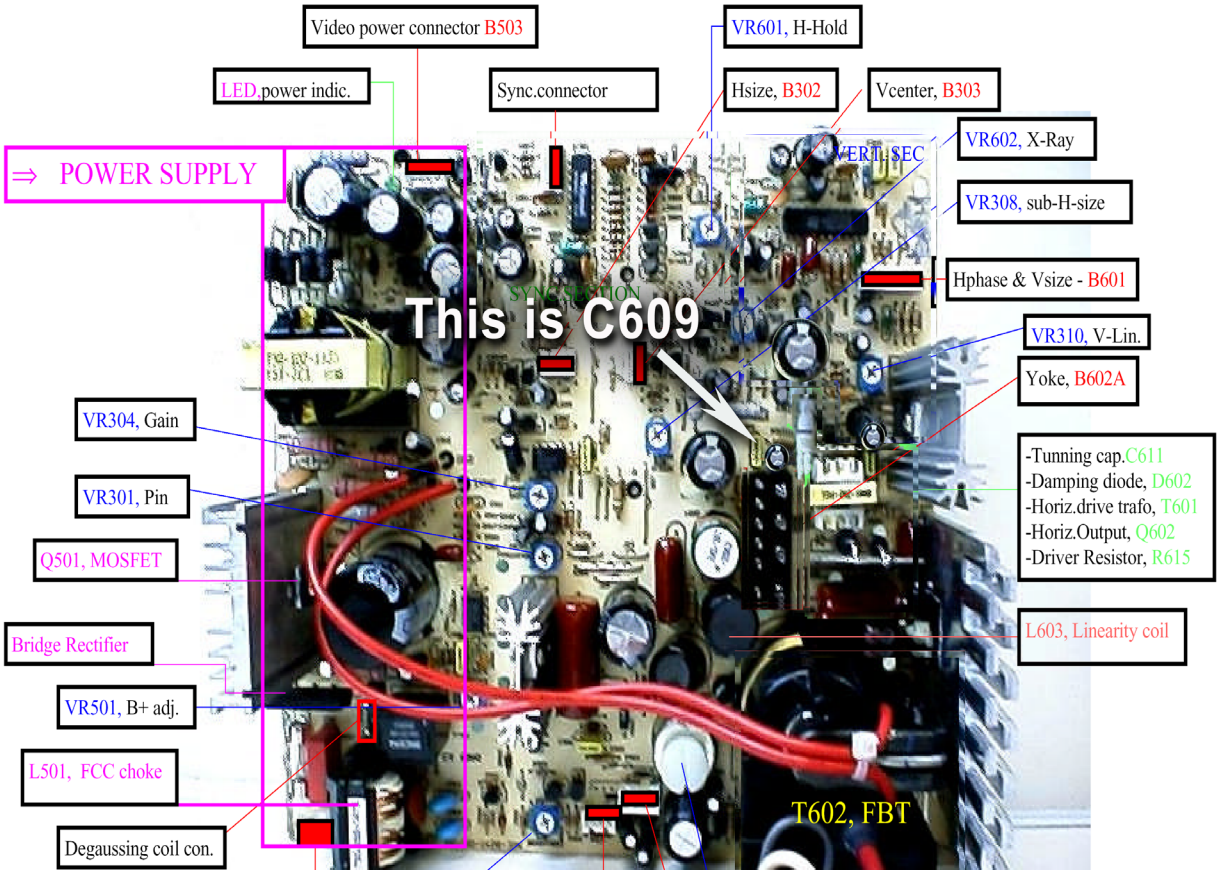
sound coming from the power transformer (normally the largest, yellow transformer on the PCB) in the SMPS.

Piece of cake to repair. Throw in a new horizontal output transistor and you're up and running. Heck, this failure doesn't even blow the fuse!

Only this time, your repair doesn't last. The horizontal output transistor immediately starts to run hot as hell and within a few minutes or hours or days, the horizontal output transistor short-circuits once again.

In a situation like this, even the most experienced monitor technicians will likely begin troubleshooting by looking at the horizontal output circuit (again, see December 2002 issue if you need a refresher on the horizontal output circuit and its associated components). They will base their troubleshooting on the theory that there is a faulty component in the horizontal output circuit that is causing excessive load on the transistor. How's the s-shaping capacitor? Maybe the flyback transformer is bad. What about the retrace tuning capacitor(s)? Maybe one of them is breaking down under the high voltages and currents that are present in the horizontal output circuit. These are all very logical troubleshooting paths to follow and, in this case, every one of them is a dead-end or a long tunnel with no light at the end (Choose your metaphor. Either way, you're screwed).

MAIN PCB, 1428-30K



In this case, the problem lies on the primary side of the horizontal drive transformer. The problem lies with failure of electrolytic capacitor C609. C609 has a subtle but in this case critical function in this circuit. C609 is in the circuit to provide a low impedance source for the primary side of the horizontal drive transformer. C609 charges up through resistor R615 during the time that the horizontal drive transistor is off. When the horizontal drive transistor is turned on, the capacitor's charge is dumped into the primary winding of the horizontal drive transformer.

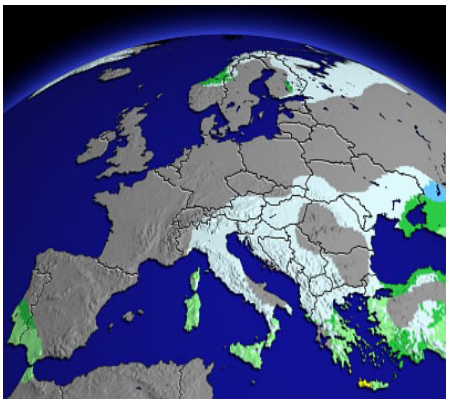
As the capacitor ages and fails, it can no longer pump sufficient current into the primary winding of the horizontal drive transformer. Naturally, if the primary winding is starved for current, the secondary winding (the output side) is starved as well.

Okay . . . Here's where it all comes together. Look at the secondary winding of the horizontal drive transformer. Look where it is connected. It is connected to the base of the horizontal output transistor - the horizontal output transistor that, due to a lack of base current, will now be operating in the highly dangerous and destructive linear region of the transistor's operating curve! Poof.

So, in this case, destruction of the horizontal output transistor has nothing at all to do with any problem with any of the components on the output side of the horizontal deflection circuit. In this case, it is a failure in the drive circuit that starts the ball rolling.

C609 is a 100mf 25 volt capacitor. It is recommended that you replace it with a capacitor with a higher voltage rating. Try using a 50 volt or 63 volt (or higher, of course. It is always permissible to use an electrolytic capacitor with a higher voltage rating.) Always use 105 degree capacitors. You will be disappointed with the longevity of 85 degree capacitors.

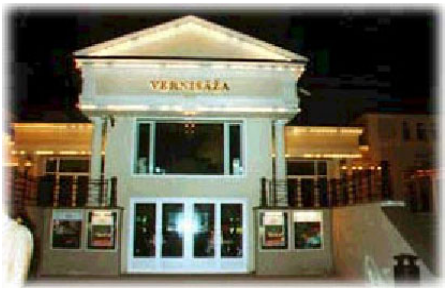
- Slot Tech Magazine



International View

By Martin Dempsey

Post & Nevada To Re-Open The Vernissage In Riga



One of Latvia's historically significant buildings is scheduled to re-open this autumn thanks to casino operator Post & Nevada. The Vernissage in Riga is undergoing extensive reconstruction and remodelling to accommodate plans for entertainment of all kinds, including gaming.

Post & Nevada's Vernissage Casino will have a total of 135 slots, 18 table games, 2 restaurants, a fitness centre and a sports betting bar. This operation will offer to its slot players an outstanding variety of game themes on IGT's Game King and Vision Series platforms.

Games with proven European player appeal such as Lucky Larry's Lobstermania, RisquT Business and Deep Pockets will deliver on both 19" slant top and upright machines. And to challenge its reel market, Post & Nevada will install Ms. Little Green Men, Double Diamond Run and Mata Hari.

These Vision Series games are 5-reel, 9-line machines with an LCD monitor that provides the same bonus action available in video slot themes. Latvia has a strong poker playing public and the casino will offer big draws like Triple Play Poker, Triple Play Five Play Poker, Ten Play Poker and Bonus Poker.

In addition to the Vernissage project, Post & Nevada has purchased another 204 machines to spice up the action in all its Latvian gaming halls. Many of the operations will install releases shown at London's 2003 ICE show. New video slots like The Great Turkey Shoot, Money Storm and Wild Bear Salmon Run top a long list of consistent winners in many European markets.

IGT is a world leader in the design, development and manufacture of microprocessor-based gaming and video lottery products and software systems in all jurisdictions where gaming and lotteries are legal.

For more information on International Game Technology, visit the company web site at http://www.IGT.com or email Karen.Thompson@IGT.com

Play The Joker Is The Latest Success From Astra

Astra's latest UK AWP release "Play the Joker" has proved to be a strong starter after an ATEI 2003 launch. Vigorous testing in both bingo and arcade sectors has led to consistent impressive results, and good initial orders.

The mid-tech game is based around a simple, fun to play game format with an added gamble feature, and a visually impressive "3-D high impact" reel in the feature. The aim of the game is to achieve 2 matching symbols on reels 1 & 3, and the joker symbol on the middle reel to enter the "Joker" top feature.

Once the player has entered the feature, by pushing the joker or start button, the reel spins to a X2, X3, X4, X5 or streak win. There are 4 streaks; red, blue, golden and mega, all of which spin the bottom reels to roll in the win! Director of Sales and Marketing Simon McCarthy believes "Play The Joker" offers the

operator a different type of game:

"Play the Joker is visually a great game with strong graphics. We've added some extra features to enhance the playability and overall game experience, reaction has been good and orders have started to roll in after the show. Again it gives the operator a different type of game that appeals to a broad range of players. "

"Play The Joker" is available in both the full height "Odyssey" cabinet and "Comfort Zone" sit down versions. For further information contact Richard Barr, Product Support & Marketing Co-ordinator. Tel: + 44 (0)1656 672804. E-mail: rbarr@astra-games.com

Synot / JPM In The Polish Market

After much waiting and speculation it seems that finally the Polish market is to benefit from some much vaunted new legislation. Czech distributor Synot has long been eager to introduce JPM products into the market and, as the only official JPM distributor in Eastern Europe, they are eagerly anticipating the proposed July 1st ratification of the new law.

Interestingly there is already JPM product in Poland but unfortunately it has been illegally supplied by Nowopol who, despite much legal process still insist on branding themselves as a JPM distributor. Operators beware as this situation cannot be allowed to last as it is not only the machines that are being copied. Advertising materials that are supplied by Synot and JPM have been taken by Nowopol and used with just the company name changing.

Synot will be playing host a number of key Polish clients at World of Entertainment show in Prague during May and key JPM staff will also be on hand to answer questions. For further information please contact Keith Fagan at gamingco@blueyonder.co.uk

New Products To Take Centre Stage At Eurotechno

Together with a revised format, which has been designed to increase interaction and networking between delegates, the Barcelona Eurotechno Conference on May 22 is poised to bring senior industry executives bang up to date with the latest trends and projects taking place across European coin-op and gaming markets.

There is a packed programme in store with top-class industry speakers plus great opportunities for networking at the pre-conference Evening Reception sponsored by Cirsa. For convenience Eurotechno is followed by Euromat's General Assembly Meeting which takes place on the 23 May providing the ideal opportunity to mix business with pleasure with a weekend in beautiful Barcelona!

For more information on Eurotechno 2003, visit http://www.eurotechno.net or telephone +44 (0) 20 7713 0302 and speak to Penny Gruber, Conference Manager, ATE Conferences. Email pgruber@ateonline.co.uk

iGGBA Announces New Officers

The Interactive Gaming, Gambling and Betting Association (iGGBA) presented its new slate of officers at its latest meeting in London. The new officers are as follows: Chairman - Andrew Tottenham, Managing Director, ROK; Vice Chairman - Roger Withers, Chairman, Arena; Treasurer - Malcolm Fraser, CFO, Ritz Interactive and Secretary - Nick Harding, Managing Director, RAL Ltd.

The Council Officers will provide leadership for the Association, given its increasing number of activities and continued effectiveness in working with the UK stakeholders on the future online licence.

For further information contact Interactive Gaming, Gambling and Betting Association (iGGBA), Friars House, 157-168 Blackfriars Road, London SE1 8EZ, England. (Tel): +44 (0)20 7620 2770. (Fax): +44 (0)20 7928 5850. Email: weshimes@iggba.org.uk or chrisguyver@iggba.org.uk Website http://www.iggba.org.uk

Entertainment Industry Jubilee In Kiev, Ukraine

From 24 to 26 September 2003, Kiev - the capital of Ukraine - will host the 10th International Specialised Exhibition "Entertainment Industry". This jubilee event, as usual, will be held by the Ukrainian Chamber of Commerce and Industry with the support of the Ukraine Association of Gaming Business, Ukraine Sport Billiard Federation and Ukraine Park Association.

The Exhibition "Entertainment Industry" takes its roots in 1993 when it gathered some young Ukrainian companies who were starting out in the coin-op business. For the last 10 years a lot of new companies operating in casino, gambling, bowling and billiard business appeared in Ukraine.

For further information contact Valeriy Valyayev, Ukrainian Chamber of Commerce and Industry, 33, V. Zhytomyrska Str., Kiev 01601, Ukraine. Phone: +380-44 / 568 57 52. Fax: +380-44 / 568 57 51. Email: vvv-expo@ucci.org.ua Website: http://www.ucci.org.ua

Barcrest Games Punchy New Game Challenges the Competition

Cash Bang Wallop is the brand new multistake machine from Barcrest Games that really packs a punch! With a full sweep of major

retailer approvals, Cash Bang Wallop is testament to the continuing high quality design that has ensured a steady stream of successful new products from the Ashton-based games manufacturer.

Cash Bang Wallop provides players with a game full of the fun and excitement that the industry has come to expect from a Barcrest Games machine. Players must win a turbo gamble to exchange into the main feature, where they can hi-lo gamble to progress into different wrap-around trails, containing cash shots, feature shots and bonuses.

For further information please contact Clare McMillan/Sam Drakeford @ england. Tel: + 44 (0)113 234 5600. Fax: + 44 (0)113 234 5601. Email: clare.mcmillan@englandagency.com

Putting the finishing touches on Latin Dancer

Big Steps In Spain: - Bally Wulff's Latin Dancer Among Top 5

Bally Wulff's efforts on the Spanish market have been successful. According to a current sales ranking in La Tribuna del Recreativo magazine, Spanish Latin Dancer AWP has reached number 5. As a result, production has now been increased again by approx. 60%.

Bally Wulff's innovative power has been rewarded. Latin Dancer, which was especially developed and produced in Berlin for the Spanish market, has reached number 5 according to the latest ranking. This positive result is based upon a representative sales survey of La Tribuna del Recreativo, which is drawn up among 40 national operators.

For further information contact Bernhard Eber. Tel.: +49-30-62002-159. Fax: +49-30-62002-222. E-Mail: b.eber@bally-wulff.de Internet: http://www.ballywulff.de

IGT Video Slots Ride The Waves With Stena Line

As in many of today's European markets, more and more Stena Line players are looking for video slots when they play. Responding to that demand, Stena management has recently closed a deal to purchase 50 of IGT's newest iGame-Plus games.

Game themes from IGT's extensive video library are soon to be installed on the Stena Germanica, Stena Scandinavica, Stena Danica and Stena Saga. These ships service routes from Sweden to Denmark and Germany, and from Norway to Denmark, with a capacity to carry approximately 2,000 passengers each.

Solid slot performers like Cleopatra, Texas Tea and Little Green Men will ship with several hits from the 2002 library - The Frog Prince, Catch a Wave and Tailgate Party - and more recent releases like Deep Pockets and Lucky Larry's Lobstermania. Poker players will see more of the ever-popular Game King Multi-Poker machines.

Gaming Manager Mats Thorsell of Stena Lines said, "We've had a long association with IGT and they have a proven record of performance with us. So, when we decided to make the shift and install more video games, IGT's large video library was the logical place to make our investment."

Stena Line celebrated its 40th year of service in 2002 and is the world's leading ferry company for international ferry traffic. With the latest in fast ferry technology, Stena Line is the market leader, servicing routes to Ireland, Holland and Scandinavia.

IGT is a world leader in the design, development and manufacture of microprocessor-based gaming and video lottery products and software systems in all jurisdictions

where gaming and lotteries are legal. For more information on International Game Technology, visit the company web site at http://www.IGT.com or contact Karen Thompson by phone at + 31 23 568 7100 or by email at Karen.Thompson@igt.com

Martin Dempsey
MD Associates
Enterprise Centre
Melitta Road
Kildare
Ireland
Email
mdassociates@eircom.net
Phone + 353 (0)45 521190
Fax + 353 (0)45 521198
Mobile + 353 (0)87 2209732

JCM Beats Competition in Head-to-Head Test

Independent Test Validates JCM's Claim of Higher Bill Acceptance

Currency handling manufacturer JCM American Corporation (JCM) has announced the results of an independent head-to-head test that, according to company officials, confirms the company's claim of higher percentage of bill acceptance. The authorized test, conducted and monitored over an eight-week period at Sam's Town Hotel & Gambling Hall in Las Vegas, pitted JCM's bill validator against that of a leading competitor.

The independent results showed JCM had a bill acceptance rate of 98.1 percent, compared to 93.3 percent of the competitor's bill validator. What's more, JCM's product required no modifications to software or replacement of any equipment.

"There is a reason JCM is the default supplier to every major OEM in the gaming industry. There's a reason JCM has exclusive relationships with seven of the top 10 major gaming operators. These independent tests make that reason very clear: JCM's products are superior to our competitors. That's not us making that claim; the test results prove it," said JCM's Vice President Tom Nugent.

The product tested was JCM's World Bill Acceptor model WBA-12-SS. The WBA is currently in use in casinos across North America. Since 1992, JCM's products have processed more than $143 trillion in cash. Widely known and respected for its cash-handling equipment, JCM consults with the US Treasury Department on anti-counterfeiting measures.

About JCM

JCM American Corporation is the industry leader in currency handling equipment. From its international headquarters in Osaka, Japan and subsidiaries in Hong Kong and Germany to its United States office in Las Vegas, Nevada, JCM's progressive spirit continues to set worldwide industry standards with innovative products such as the World Bill Acceptor (WBA). JCM provides its products, software and services to the gaming, banking, amusement, vending and petroleum industries.

For more information, visit www.jcm-american.com.

"JCM's products are superior to our competitors. That's not us making that claim; the test results prove it," said JCM's Vice President Tom Nugent.

Slot Tech Show Report

Summit supports its operators with a range of free technical training programs. Topics covered during the two-day event include bill validator repair, ticket printer repair, two full days of monitor repair and, of course, a full run-through on Summit machines.

The hosts with the most - Summit's Skip Johnson (l) and Tim Carson take a moment away from the fun to take a quick snapshot for Slot Tech Magazine. Summit showed their range of equipment for the Montana and South Dakota market.

Some fifty operators from Montana and South Dakota attended the tech classes presented by JCM's Tom Talbot (left) and Ithaca's Dennis Salmela (above). A two-day monitor repair clinic was presented by Slot Tech Magazine.

What Am I Looking At?

The Philosophy of Using an Oscilloscope to Interpret Waveforms

Regular readers of Slot Tech Magazine know that I am a proponent of "cheap-and-dirty" game repair. As a service tech, I rarely have a reason to use sophisticated test equipment. Despite the fact that I love using the latest and greatest oscilloscopes, testers and signal generators, most of my repairs are done with a digital multimeter, a little common sense and lots of practical experience (There's nothing like OJT when it comes to learning.). I leave most of the more sophisticated repairs to the manufacturer's technicians. They have the experience, skill and specialized parts and equipment needed to effect repairs on CPUs and dense PCBs that use itty-bitty surface-mount devices. The little PCB in Ithaca's printer is a good example. It's a small, seven-layer PCB that, to be honest, I'd just rather not mess around with.

But I believe that all casinos and video slot operators can and should be more-or-less self-sufficient as far as monitor repair is concerned. Most of the time, monitor repair is fun and easy. Most failures are easily diagnosed using the aforementioned digital multimeter. Slap in a new component or two, maybe replace a fuse and you're up and running.

But every now and then I get to repair a monitor where the cause of the problem is not immediately apparent. In other words, after thinking about how a monitor works and how my symptom might be related to any of the circuits, I usually start by turning off the power and visually examining the chassis for anything obvious like bad caps, burned resistors, fractured solder joints, etc. The next step is a quick test of the semiconductors (in-circuit) for any obvious failures. Naturally, I only test those components that might have something to do with my problem. I would not, for example, look at the video amplifier circuit if I have a failure that's blowing a fuse. There's just no possible way that any failure in the video amplifier would cause a fuse to open.

My next step is to turn the monitor back on and measure some key DC voltages such as the B+ and any other power supplies. These are easy measurements that can be handled with a digital multimeter.

But if I haven't found the cause of the problem at this point, the path of troubleshooting can diverge onto separate paths. Both paths are legitimate troubleshooting techniques for bench techs whose only goal is to get the darned thing fixed in as little time as possible.

One way to go here is a technique where the components in the circuit are "shotgunned." To shotgun a circuit is to remove and replace most or all of the possibly defective components regardless of whether or not they test good or bad (or even if they've been tested at all, for that matter). All you need here is a basic knowledge of which components might have something to do with the problem and the ability to solder; the ability to remove and replace components without destroying the PCB.

This is a perfectly acceptable way to fix something when you don't posses the knowledge and/or test equipment to get the job done any other way. At times it can be the fastest way to fix something, gambling that "it's just gotta

ADVERTISEMENT

Randy Fromm's Casino School

On-Site Technician training

Randy Fromm's Casino School is a practical, no-nonsense look at how gaming machines work and how to repair them when they don't. **No previous knowledge of electronics is required** to get the most out of the school. The Casino School is geared for those who want to learn how to fix gaming devices without having to learn complex electronic theory or purchase expensive test equipment.

Be prepared for six hours of accelerated learning each day. Class begins at 9:00 am sharp each day and continues until 4:00 pm. The Casino School provides each student with reference materials and troubleshooting guides that will be valuable aids for repairing equipment on location and in the shop.

Students learn how to work with:

THE DIGITAL MULTIMETER

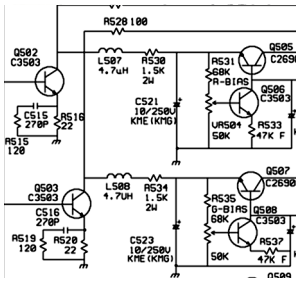
This relatively inexpensive piece of test equipment is easy to operate. Casino School students learn to use the digital multimeter to perform tests and measurements that will pinpoint the cause of a failure down to a single component.

ELECTRONIC COMPONENTS

The individual components used in games are introduced. Parts such as resistors, capacitors, diodes, potentiometers and transistors are covered individually. Students learn how the components work and how to test them using the meter.

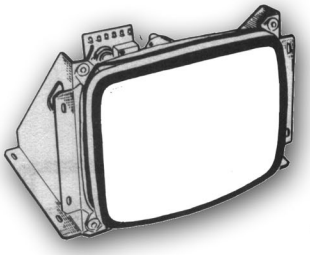
SCHEMATIC DIAGRAMS

Schematic diagrams are the "blueprints" for electronics. Learning to read schematics is easy once you know how the parts work!



POWER SUPPLIES

Power supply failure is a common complaint in many different types of systems.. Power supply failures are discussed during the class, along with shortcuts for troubleshooting and repairing them.



MONITOR REPAIR

The monitors used in video slots are designed for quick, easy, and safe repair. Students will learn the theory of operation of all types of monitors and how to repair monitors down to the component level. Of course, monitor safety will also be discussed.

You do not have to send your slot techs to Las Vegas or Atlantic City for training. The Casino School brings the training to you. Contact Randy Fromm's Casino School today to reserve a date for your tech school

Randy Fromm's Casino School 1944 Falmouth Dr. El Cajon, CA 92020-2827
tel.619.593.6131 fax.619.593.6132 e-mail CasinoSchool@slot-techs.com
For a complete brochure, visit the website at: slot-techs.com

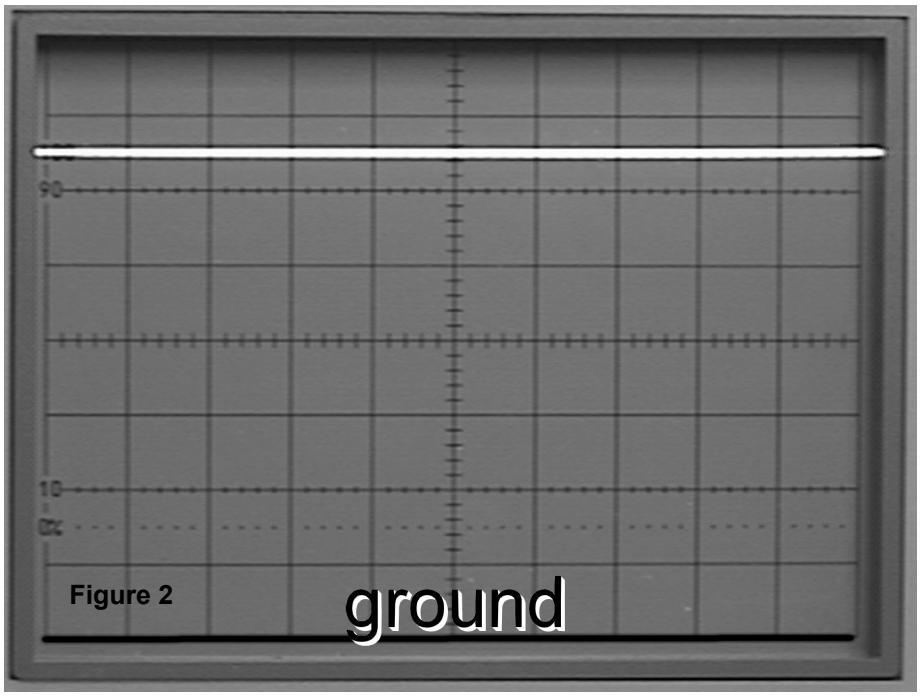


Figure 2

The output of the power supply is not too exciting, waveform-wise. It's just a straight line. It's pure DC (or, at least it's supposed to be) and the oscilloscope shows it here.

be The Chip" and replacing it rather than taking the time to determine if it's really bad. ICs are usually pretty cheap. Often, they can be removed without damaging them so that, even if you're wrong about the integrated circuit being faulty, there's "No harm, no foul."

Some technicians "poo-poo" this technique as unprofessional. Better, they say, to use your skills with an oscilloscope to isolate the failure to the exact cause of the problem and fix it, rather than changing a mess of parts and keeping your fingers crossed. I can't say that I disagree with them in that regard. This path is a much more scientific approach to troubleshooting and a wonderful exercise in logical thinking.

However, to travel along this path requires a service tech to jump to the next level in troubleshooting. It's a journey well taken but it requires a couple of key items in order to be successful. One is a firm grasp on how to operate an oscilloscope. This subject was covered in detail in Slot Tech Magazine's special two part presentation, "Understanding the Oscilloscope" that appeared in the March and April, 2002 issues.

The other key to successful troubleshooting is the most hard-won accomplishment. You have to know how the circuits function and how to interpret the waveforms displayed by the oscilloscope. I'm not just talking about measuring the voltage, time or frequency of a signal. I mean you have to know how the operation of the circuit produces the waveform you see. Just as importantly (or maybe even more importantly) you must be able to recognize when a waveform is not normal and, combined with your knowledge of how the circuit is supposed to function and how components fail, postulate as to what possibly might have failed to cause the waveform to look as it does. You can see how this really requires an enormous leap in troubleshooting skills and really makes you appreciate the fact that you can always fall back on the shotgun technique.

In future issues of Slot Tech Magazine, we'll take an in-depth look at each of the circuits in a monitor and examine not only how the circuit operates but also take a close look at waveform analysis and step-by-step troubleshooting using the oscilloscope. By the way, the troubleshooting techniques used for monitor repair are directly transferable to all manner of electronic troubleshooting. If you can master the skills needed to troubleshoot monitors with an oscilloscope, you are ready to follow any number of different paths in your career and learn all manner of electronic repair.

The Power Supply

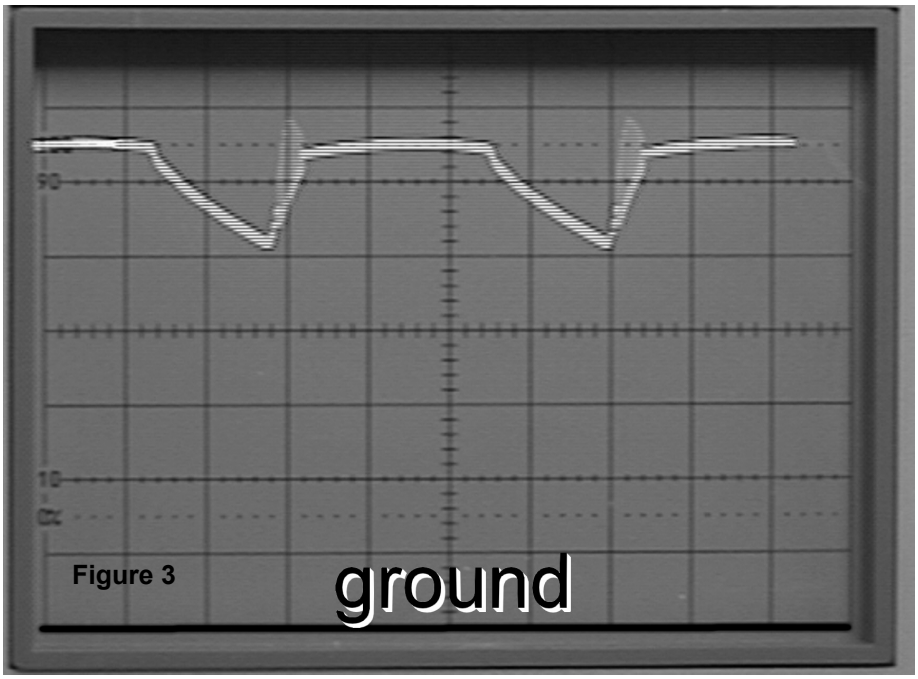
Okay . . . I admit it. The chances of having to use an oscilloscope to repair a power supply are pretty slim. However, the B+ power supply is, directly or indirectly, related to every other circuit in the monitor and its health is important.

When troubleshooting with an oscilloscope, we often start at the bad output of a circuit and work our way back to the input. When the signal goes from bad to good, we've located the problem. Whatever's between bad and good has to be at fault. This is, of course, why you need to know how the circuit operates and what's supposed to be happening at each point in the circuit.

The output of the power supply is not too exciting, waveform-wise. It's just a straight line. It's pure DC (or, at least it's supposed to be) and the oscilloscope shows it in figure 2. The voltage is 130 volts DC, just as it says on the schematic diagram.

In its simplest form, this is what troubleshooting with the oscilloscope is all about. You measure the output, read the display and, armed with the knowledge that a straight line at the 130 volt mark is exactly what it's supposed to be, you declare the power supply to be good. Of course, in the real world this measurement is more easily accomplished with a digital multimeter.

But what if you see something like the waveform in figure 3? What's up here? What happened to the straight line? You are looking at power supply ripple. Sometimes, a fluctuating voltage will "ride" on the top of a steady, DC voltage. This signal may be only a fraction of a volt but in a worst-case scenario can amount to as much as half the peak voltage and it's riding on top of this DC voltage. If you want to take a closer look at a small amount of ripple, you may need to boost the sensitivity of the vertical input to see it. Lowering the volts/div enough to see the ripple causes the displayed line to disappear off the top of the screen due to the DC component of the signal. Flip the "input coupling" switch to "AC." This places a capacitor in series with the input to the oscilloscope. The input coupling capacitor blocks the DC component of the signal, allowing only the AC ripple through to the vertical input of the scope.



You are looking at power supply ripple. Sometimes, a fluctuating voltage will "ride" on the top of a steady, DC voltage.

So what can cause the ripple? Generally, this is caused by bad filter capacitors. This is not uncommon for the B+ filter caps. Typical value for the filter capacitors in the B+ power supply of a monitor is 100 microfarads, 160 volts. Here again, in the real world you're likely to NOT need an oscilloscope here as bad filter caps will often manifest themselves with domed tops or other visual clues.

This, in a nutshell, is the essence of troubleshooting with the oscilloscope. Of course, this is just the beginning; the "philosophy" if you will. In the future, we'll look at waveforms in other circuits.

- Slot Tech Magazine

Subscriptions & Back Issues

Why back issues of Slot Tech Magazine are important to own . . .

Slot Tech Magazine is strictly technical. As such, the magazine's contents are not time critical. The repair information and technical data contained in past issues is just as valid today as it was the day it was published.

Additionally, current and future articles more-or-less assume that readers are already familiar with what has been covered in past issues. This editorial policy assures that Slot Tech Magazine's contributing writers are not limited to "writing down" to the level of a novice technician but are free to continue to produce the most comprehensive technical articles in the gaming industry.

Randy Fromm's
Slot Tech Magazine is published monthly by:
Slot Tech Magazine
1944 Falmouth Dr.
El Cajon, CA 92020-2827
tel.619.593.6131
fax.619.593.6132
e-mail editor@slot-techs.com

Subscription rates:

Domestic (USA)
1 year - $60.00
2 years - $120.00

International
1 year - $120.00
2 years - $240.00

Back Issues

All single issues of Slot Tech Magazine are $10.00/ea. For further details on the contents of each issue, please refer to the website at slot-techs.com

- ☐ May, 2001
- ☐ June, 2001
- ☐ July, 2001
- ☐ August, 2001
- ☐ September, 2001
- ☐ October, 2001
- ☐ November, 2001
- ☐ December, 2001
- ☐ January, 2002
- ☐ February, 2002
- ☐ March, 2002
- ☐ April, 2002
- ☐ May, 2002
- ☐ June, 2002
- ☐ July, 2002
- ☐ August, 2002
- ☐ September, 2002
- ☐ October, 2002
- ☐ November, 2002
- ☐ December, 2002
- ☐ January, 2003
- ☐ February, 2003
- ☐ March, 2003
- ☐ April, 2003

Company Name _____

Contact _____

Address _____

Address _____

City _____ **State/Prov.** _____

Country _____ **Zip/Postal Code** _____

Telephone _____ **Fax** _____

E-mail _____

Type of card: [ ] American Express
[ ] Discover
[ ] MasterCard
[ ] Visa

Account Number: _____

Expiration Date: _____

[ ] 1 year subscription, domestic
[ ] 1 year subscription, international
[ ] 2 year subscription, domestic
[ ] 2 year subscription, international